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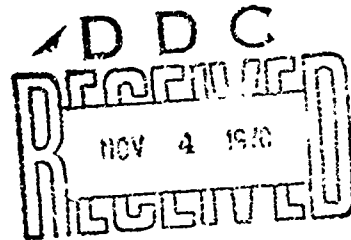
**Conversion  
of  
Hobart Model C-100 Electric Mixer to Air Drive  
for  
Use In Mixing Pyrotechnic Compositions**



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NAVAL AMMUNITION DEPOT  
Crane, Indiana 47522

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CONVERSION OF HOBART MODEL C-100  
ELECTRIC MIXER TO AIR DRIVE FOR USE IN  
MIXING PYROTECHNIC COMPOSITIONS

By  
PATRICK L. ARVIN  
and  
SHERMAN E. DARE

This report was reviewed for adequacy and technical accuracy by  
Robert E. Sloan, Mechanical Engineer.

Released

  
S. M. FASIG, Director  
Research and Development Department

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RDC-3-250 - Shaft, Hobart Model C-100 Mixer, Modified	
RDC-3-206 - Spacer	
RDC-3-208 - Coupler	
RDC-3-209 - Hobart Mixer Air Motor Adaptation (10 Qt)	
RDC-3-207 - Support, Bearing	

## I. INTRODUCTION

A. During development of a Catalyst Generator at Naval Ammunition Depot, Crane, Indiana, a special need arose for a somewhat universal mixer to thoroughly blend pyrotechnic mixes of various types under special conditions.

The search for a mixer which could be used to mix these pyrotechnic mixes of approximately 10 lbs. in size, on a reproducible as well as a productive basis led to the Model C-100 (Planetary Action) Mixer manufactured by the Hobart Manufacturing Company, Troy, Ohio.

B. Preliminary testing of this mixer, with its planetary action, proved that it could meet the criteria already mentioned. One problem remained however, the Model C-100 Mixer is equipped from the factory with the standard type electrical motor and related equipment which would not permit the Model C-100 to be used to mix pyrotechnic mixes because of safety requirements.

Since this mixer provided the proper mixing action, it was suggested that the electrical motor and related controls (switches) be replaced with an air motor to adapt this mixer to meet the safety requirements involved.

The following is a description of how the Model C-100 Mixer was converted from electrically to air driven power.

## II. MATERIAL REQUIRED

A. Hobart Model C-100 Mixer (with or without electrical motor). If the mixer is without the KFB-C-100 motor, Hobart Part No. P-22275-86 (Rotor Assembly) will also be needed. This should include the grease deflector (M-62489) and ball bearing (BB-16-1).

- B. Gast Air Motor Model 6AM-NRU-11 (flange mounting)
- C. Bearing (Norma-Hoffmann 204-KK) - .7874 inch I.D., 1.8504 inch O.D. (Two required - one should come with mixer)
- D. Bearing Support (RDC-3-207)
- E. Spacer (RDC-3-206)
- F. Coupler (RDC-3-208)
- G. 3/16" square key - length as required
- H. Screw-Round Head #8-32 x 2 1/4" long (4 required)
- I. Washer for #8 screw (4 required)

### III. REMOVAL OF THE ELECTRIC MOTOR AND ELECTRICAL COMPONENTS

A. First remove the back bearing bracket. Part of the centrifugal switch will stay intact with this bracket (see Figure 1). Next remove the two wires from this part of the centrifugal switch. The rotor assembly is now ready to be extracted. This is done by pulling directly out while slowly turning the agitator shaft on the mixer. This assembly will include the rotor, shaft, ball bearing, grease deflector, worm gear, and part of the centrifugal starting switch (see Figure 1). Now remove the data plate on the back of the mixer (Part #18 - Figure 2). This permits access to the capacitor which is mounted inside. Disconnect the two wires from the capacitor and remove the capacitor and capacitor bracket. The two wires removed from the capacitor can now be pulled up into the motor housing to the stator assembly. Next disconnect the two wires from the plug-in cord. One wire is located at the manual switch (Part #15 - Figure 3) on the side of the machine next to the gear selector. This necessitates the removal of the shifter handle.

While the switch plate is off, disconnect the two wires and remove the switch. Also remove the ground wire from the housing inside.

The other wire from the input cord is connected to the stator. With this wire disconnected the stator is ready to be removed. Four studs on the outer periphery of the stator which held the back bearing plate are all that secures the stator. With these studs removed the stator can be removed by pulling directly out while tapping on the housing.

The only thing remaining to be removed is the input cord. Remove the fiber bushing and strain relief from the cord and pull the cord out through the hole in the housing.

#### IV. MODIFICATION OF ROTOR ASSEMBLY

A. The shaft of the rotor assembly which was extracted from the mixer must be modified to comply with Drawing No. RDC-3-250. This assembly includes the rotor, shaft, ball bearing, grease deflector, worm gear, and part of the centrifugal starting switch (see Figure 1). The rotor and the centrifugal switch must be pressed off the shaft. This may be done with or without the bearing and grease deflector in place on the shaft. Care should be taken so that the worm gear, bearing, grease deflector, and shaft are not damaged in this process. With the rotor and centrifugal switch off of the shaft, the shaft can be chucked in a lathe and modified.

## V. MODIFICATION OF GAST AIR MOTOR MODEL 6AM-NRV-11

A. Modification of Gast Air Motor requires disassembly of the motor. The shaft must be shortened to comply with the .418 inch dimension appearing on Dwg. No. RDC-3-209. This requires measurement of the shaft extension before disassembly. This should comply with the drawing included with the performance data given which is supplied by the Gast Manufacturing Company. The keyway on this shaft must now be cut another .50 inches toward the rotor.

With the air motor apart, the front mounting flange can be modified. This requires that the outside diameter of 6 1/2 inches be machined down to a diameter of 5.995 inches, the same as the outside diameter of the bearing support (RDC-3-207). This permits entry into the mixer housing. The flange must also be faced to a thickness of .400 inches as seen in Dwg. No. RDC-3-209. This leaves a flat surface for the four mounting screws to secure the assembly.

## VI. ASSEMBLY OF THE AIR MOTOR TO THE MIXER

A. First of all, press the ball bearing and grease deflector, if removed, back onto the modified worm gear shaft in the same position as previously occupied. Next, press a second ball bearing (Norma-Hoffmann 204-KK) in appropriate position into the bearing support (RDC-3 207) as shown in Dwg. No. RDC-3-209. This bearing and bearing support can now be pressed onto the other end of the

modified worm gear shaft. Only light pressure should be required to press either bearing into position. This assembly which should include the worm gear shaft, two ball bearings, the grease deflector, and the bearing support is ready for insertion into the mixer housing.

To insure proper position of the four outer holes in the bearing support, the studs which held the old stator assembly may be used for proper alignment. Turning of the agitator shaft on the mixer during insertion of the worm gear assembly helps draw the assembly firmly into place. Inspection through the hole by the shifter handle insures proper seating of the bearing support and also the inner bearing. The 3/16" square key and coupler (RDC-3-208) can now be added to the worm gear shaft with the relieved end outward (see RDC-3-209).

Next, the spacer (RDC-3-206) can be pressed onto the modified Gast Air Motor, as shown in Dwg. No. RDC-3-209. This need not be a press fit but the press fit helps to hold the assembly in place and insures proper positioning of the spacer in the final assembly. This air motor and spacer assembly is now ready for insertion into the mixer housing against the bearing support. The key-ways must be lined up prior to insertion by turning either of the two shafts. Sharp edges should be filed and may be filed to a slight taper to ease alignment. The four alignment studs may now be replaced by four 2 1/4 inch, #8-32 round head screws with flat washers. These four screws will secure the entire assembly (see RDC-3-209).



## VII. THE GAST AIR MOTOR

### A. Operation

The Gast Air Motor can be used in any position providing adequate lubrication is administered through an air line oiler and end thrust is kept to absolute minimum. For best results, assemble the air motor so that the inlet and exhaust ports are on top since this is where the oilers are for intermittent operation of the air motor. For continuous operation, the air line oiler must be used. Gast Manufacturing Company recommends use of their accessories for the Model 6AM Air Motor for longer life, proper operation, and dependability. These accessories include filter, regulator, lubricator, and lubricating oil, part numbers 4F103, 4R001G, 4L002, and AD220, respectively.

For moderate speeds (under 2,000 r.p.m.) or intermittent operation, 1 squirt of oil in bearing oilers per day will suffice. If the duty is continuous or speed is high, use an automatic air line oiler set to feed 1-3 drops per minute. The bearings will receive oil from the rotor chamber during automatic oiling. Lubrication is necessary for the bearings, shaft seals, and rust prevention. Excessive moisture in the air line can cause rust formation in motor and might also cause ice to form on muffler due to expansion of air through the motor. The moisture problem can be corrected by installing a moisture separator in the line and also by installing an aftercooler between the compressor and air receiver.

If the motor is sluggish or inefficient, try flushing with kerosene in well ventilated area. Disconnect the air line and muffler and add several teaspoonsful of kerosene. Rotate the shaft by hand in both directions for a few minutes, again connect the air line and apply pressure slowly until there is no trace of kerosene in exhaust air. (Keep face away from exhaust air) Check the muffler felts for grease, dirt, etc. If dirty, wash them in solvent. Replace the felts and connect the muffler. Relubricate the motor with a squirt of oil in the chamber and bearing oilers.

#### B. Performance

The speed of the air motor can be easily adjusted to operate from 300 to 3000 rpm. The Gast Model 6AM delivers up to 3 horsepower, as seen on the performance data sheet. This provides more than enough power to mix most pyrotechnic mixes since it replaces a 1/4 horsepower electrical motor previously in the mixer. Certain characteristics should be known about the air motor; however.

(1) Horsepower of an air motor is relative to RPM and to air line pressure.

(2) An air motor slows down when load increases at the same time its torque increases to a point where it matches the load. It will continue to provide increased torque all the way to stall condition. It can maintain the stalled condition without any harm to the motor.

(3) As the load is reduced, an air motor will increase speed and the torque will decrease to match the reduced load.

(4) When the load on an air motor is either increased or decreased, speed can be controlled by increasing or decreasing air pressure.

(5) Starting torque of an air motor is lower than running torque. While this provides smooth, no-shock starting, it is necessary to have additional airline pressure for starting under heavy loads.

(6) Air consumption increases as speed and air pressure are increased.

(7) It's simple to change horsepower and speed of an air motor by throttling the air inlet. Therefore, the best rule of thumb for selecting an air motor is to choose one that will provide the horsepower and torque required using only 2/3 of the line pressure available. The full airline pressure will then be available for overloads and starting.

This explains why the Model 6AM Air Motor was chosen to replace the low horsepower electric motor. The next smaller model is the 4AM which develops less than 1/4 horsepower at 300 RPM, as can be seen from the air motor selection chart.

#### VIII. INSTRUCTIONS FOR OPERATION AND CARE OF THE MODEL C-100 HOBART MIXER WITH GAST AIR MOTOR

A. As before with the electrical motor, the air motor must be stopped to shift the mixer to a different speed to prevent damage

to the gears in the mixer.

B. The transmission gearing is packed with a special grease that will last for several years. When grease is needed for replacement, it should be ordered from the Hobart Manufacturing Company. Lubricate the bowl slideways occasionally by applying a very small amount of oil with the tip of your finger. Only mineral oils are suitable for this type of lubrication. The polished drip cup is a safe-guard to prevent any lubricant that might work out of the planetary gearing from dropping into the bowl. Take off the drip cup (by removing the two screws) periodically and wipe it clean.

C. To raise the bowl, pull the long lever on the side of the mixer down until it catches in the detent which holds it in position. It is necessary to lower the bowl in order to change agitators and also makes the bowl more accessible for filling.

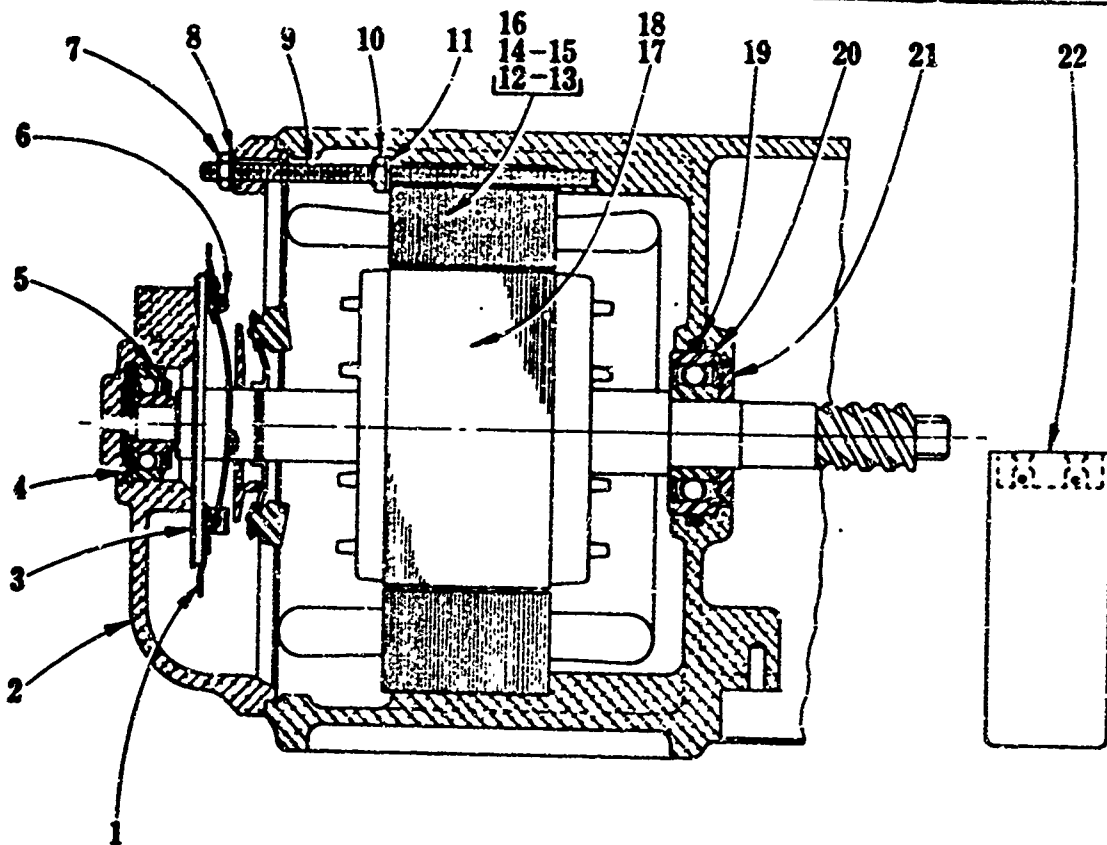
D. The replaced electric motor was operated at a speed of 1725 RPM. This gave the mixer three positive speeds for the agitator. These three speeds are as follows:

(GEAR)	(AGITATOR SPEED)
Low	144 RPM
Intermediate	258 RPM
High	450 RPM

The mixer now has a wide range of speeds since the air motor speed can be varied. Caution should be taken not to exceed the engineered design limits of the mixer. With the wide range (25-500 RPM)

of speeds for the agitator, there should be no reason to exceed the speed of the electrical motor, 1725 RPM, which was replaced. The graph of agitator speed vs air motor speed shows this speed range. As noted, this agitator speed does not include the planetary action of the agitator.

# **MOTOR** **REPLACEMENT PARTS**



**Type of Motor - KFB-C-100**

**Motor ML1634I-A,B,C,L,M**

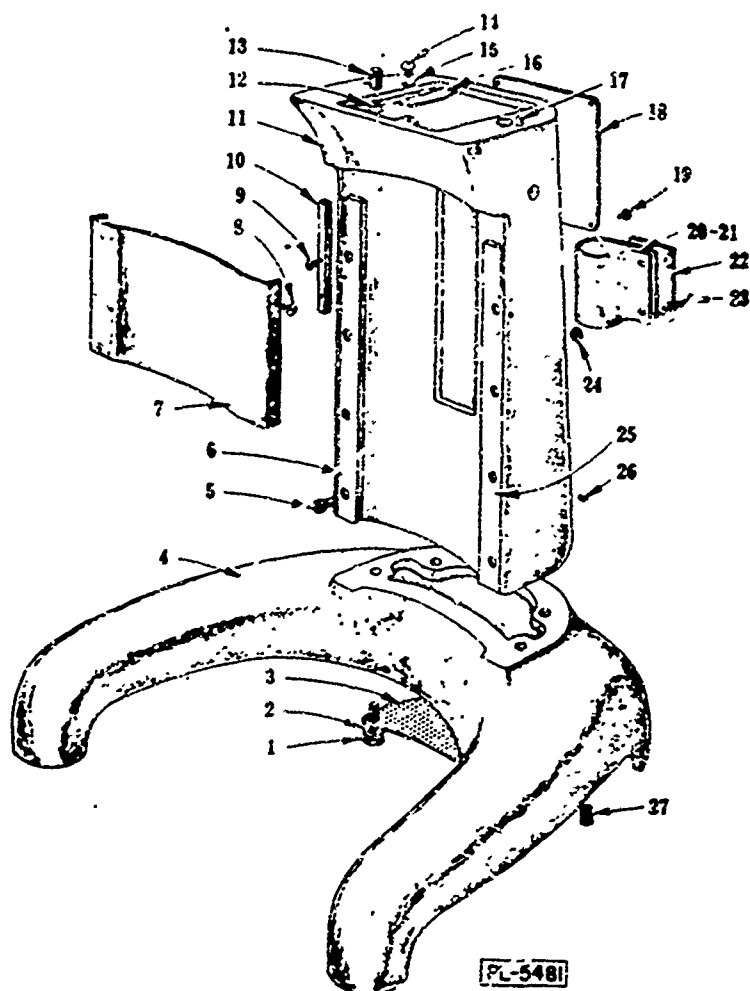
Motor type and ML number are stamped on motor (sometimes under name plate).

**When ordering motor replacement parts, in addition to motor Type and ML No., give Serial No., Model, ML, and all electrical data shown on machine name plate.**

Illus. No.	Part No.	Name of Part	Amt.
1	M-74266-1	Switch - Starting (Stationary Part) -----	1
2	R-20647-2	Bracket - Bearing -----	1
3	M-78437	Insulator - Starting Switch -----	1
4	SL-2-2	Loading Spring - N. D. #S-12 -----	1
5	BB-16-1	Ball Bearing - N. D. #C87011 -----	2
6	SC-9-70	Mach. Screw - #6-32 x 1/4" Rd. Hd. -----	2
7	NS-9-12	Mach. Nut - #8-32 Hex -----	4
8	WL-7-6	Lock Washer - #8 Ext. Shakeproof -----	4
9	M-61671	Stator Stud - #8-32 x 4-5/8" Lg. -----	4
10	NS-9-12	Mach. Nut - #8-32 Hex -----	4
11	WS-2-15	Washer -----	4
12	P-65477-12-1	Stator Assy. (115V., 60 Cy., 1 Ph.) (Item #1 not included) -----	1
13	P-65477-12-2	Stator Assy. (208V., 60 Cy., 1 Ph.) (Item #1 not included) -----	1
14	P-65477-12-3	Stator Assy. (230V., 60 Cy., 1 Ph.) (Item #1 not included) -----	1
15	P-65477-13-1	Stator Assy. (115V., 50 Cy., 1 Ph.) (Item #1 not included) -----	1
16	P-65477-13-2	Stator Assy. (220V., 50 Cy., 1 Ph.) (Item #1 not included) -----	1
17	P-22275-86	Rotor Assy. (60 Cy.) -----	1
18	P-22275-87	Rotor Assy. (50 Cy.) -----	1
19	R-67500-20	"O" Ring -----	1
20	C-17-19	Ball Bearing - N. D. #Z99504 -----	1
21	M-52489	Collector - Grease -----	1
22	P-70487-7	Capacitor -----	1

**FIG. 1**

# C-100 REPLACEMENT PARTS

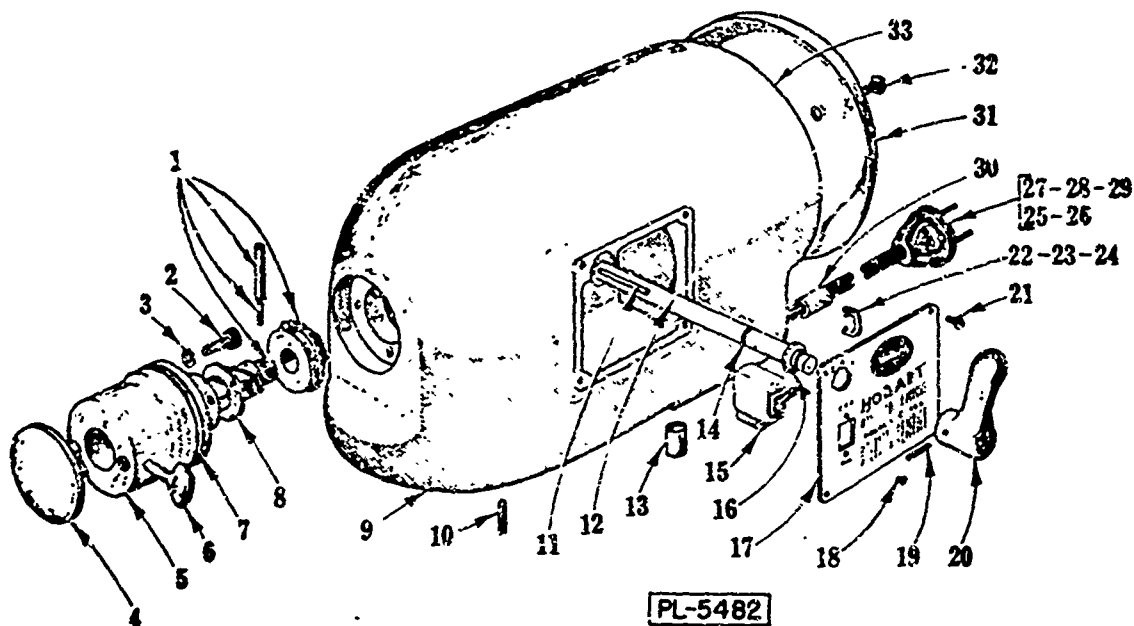


BASE AND PEDESTAL UNIT

ILLUS. NO.	PART NO.	NAME OF PART	AMT.
1	SC-34-27	Fin. Bolt - 5/16"-18 x 1" Hex Hd.	4
2	WL-3-44	Lock Washer - 5/16" x .125" x .075"	4
3	P-76507	Screen - Air	1
4	T-61650-1	Base	1
5	SC-40-51	Cap Screw - #8-32 x 1/2" Soc. Flt. Hd.	8
6	P-61638-1	Slideway - Left Hand	1
7	P-61635	Apron	1
8	SC-9-93	Mach. Screw - #6-32 x 1/4" Rd. Hd.	4
9	SC-7-23	Mach. Screw - #6-32 x 3/8" Rd. Hd.	4
10	M-61669	Block - Apron	2
11	T-61683-1	Pedestal	1
12	WL-4-2	Lock Washer - 3/8" x .136" x .070"	2
13	SC-36-57	Fin. Bolt - 3/8"-16 x 1-1/4" Hex Hd.	2
14	SC-7-41	Mach. Screw - #8-32 x 3/8" Rd. Hd.	1
15	WL-3-15	Lock Washer - #8 x .047" x .031"	1
16	M-61649	Spring - Bowl Lift Detent	2
17	P-11800-88	Dowel	2
18	B-103012	Plate - Mach. Data & Back Cover (Give serial No. & elec. spec.)	1
19	SC-12-26	Mach. Screw - #6-32 x 1/4" Blind Hd.	4
20	M-20334	Bracket - Capacitor (60 Cy.)	1
21	M-21227	Bracket - Capacitor (50 Cy.)	1
22	M-64228	Support - Capacitor Bracket	1
23	SC-15-36	Mach. Screw - #10-24 x 5/8" Oval Hd.	2
24	NS-8-21	Mach. Nut - #10-24 Hex	2
25	P-61639-1	Slideway - Right Hand	1
26	SC-47-71	Set Screw - #6-22 x 1/8" Soc. Hdls. Flat Pt.	2
27	SC-57-15	Set Screw - 3/8"-16 x 5/8" Hdls. Cup Pt.	4

FIG. 2

# C-100 REPLACEMENT PARTS



## TRANSMISSION CASE UNIT

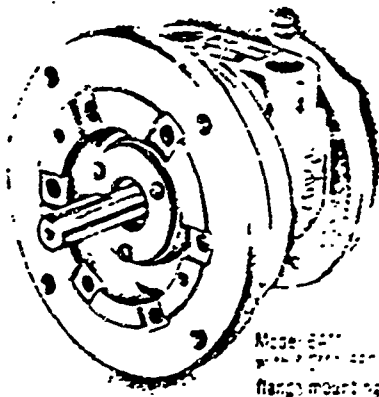
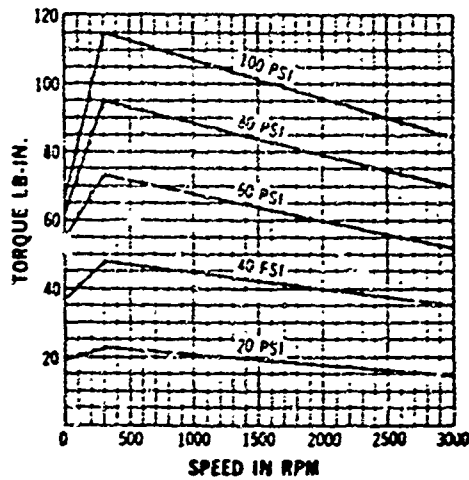
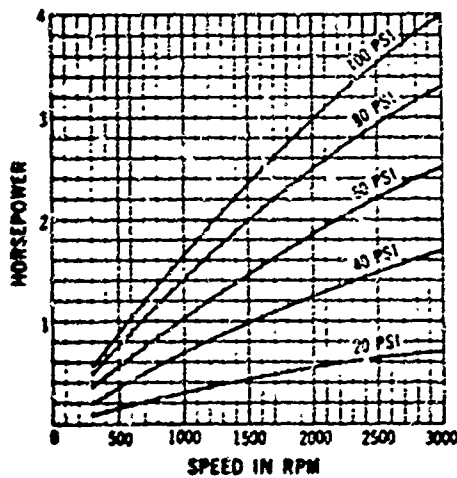
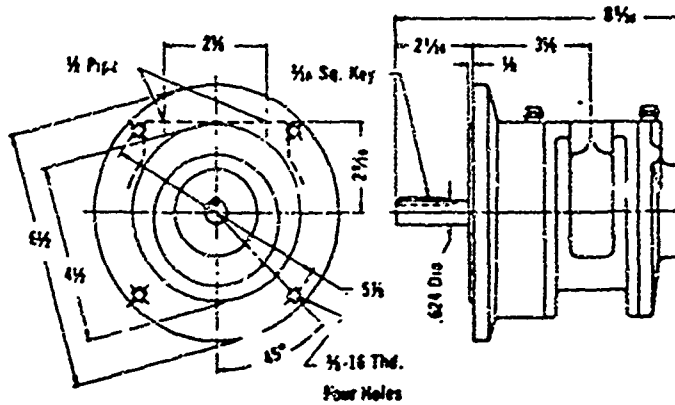
ILLUS. PL-5482	PART NO.	NAME OF PART	AMT.
1	M-65464	Square Drive Shaft & Zerol Bevel Gear Assy. (23T)	1
2	SC-40-33	Cap Screw - #10-24 x 7/8" Soc. Flt. Hd.	3
3	WL-3-23	Lock Washer - #10 x .070" x .058"	3
4	M-61838	Cover - Attachment Hub	1
5	P-61631	Hub - Attachment	1
6	M-5500	Thumb Screw	1
7	R-67500-20	"O" Ring	1
8	M-61667	Washer - Thrust	1
9	M-62628	Gear Case, Dowel & Bushing Sub-Assy. (Incls. Items #10 & 13)	1
10	P-11800-84	Dowel	1
11	R-12430-3	Key	1
12	M-61853	Rod - Shifter	1
13	M-61672	Bushing (Fiber)	2
14	R-67500-2	"O" Ring	1
15	M-61870	Switch	1
16	RR-4-4	Retaining Ring	1
17	B-102576	Plate - Switch	1
18	SC-9-87	Mach. Screw - #3-48 x 1/4" Rd. Hd.	2
19	PG-3-32	Groov-Pin - Type #1, 1/8" x 3/4"	1
20	M-61677	Handle - Shifter	1
21	SC-15-6	Mach Screw - #6-32 x 1/4" Oval Hd.	4
22	FE-6-15	Strain Relief (For Item #23)	1
23	FE-6-16	Strain Relief (For Item #26)	1
24	FE-6-32	Strain Relief (For Items #27 & 28)	1
25	S-63335-12	Cord & Plug (2 Cond., Under 125 V.)	1
26	S-63335-17	Cord & Plug (2 Cond., 200-250 V.)	1
27	S-63335-30	Cord & Plug (3 Cond., Under 150 V.) (Ground)	1
28	S-63335-43	Cord & Plug (3 Cond., 200-250 V.) (Ground)	1
29	R-64898-4	Cord - Export	1
30	M-61672	Bushing (Fiber)	1
31	P-61634	Cover - Bearing Bracket	1
32	SC-10-13	Mach. Screw - #10-24 x 3/8" Truss Hd.	1
33		Motor (see separate Motor Parts Sheet)	1

FIG. 3



6AM

**Performance Data:** Delivers up to 3 hp. Speed may be varied from 300 to 3000 rpm; hp is relative to rpm. Maximum recommended operating pressure—100 psi. Performance curves shown are for reversible models. Air consumption curves will be slightly lower for single rotation units.



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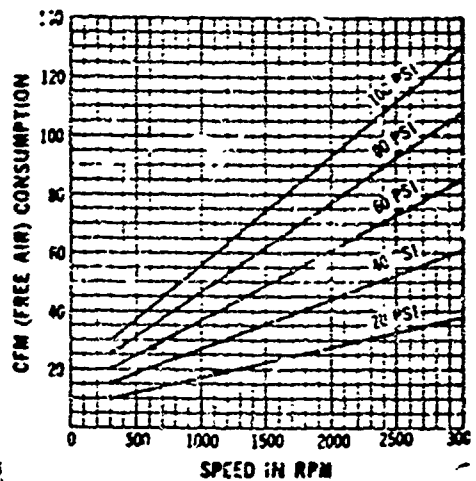


FIGURE 4

# AIR MOTOR SELECTION CHART

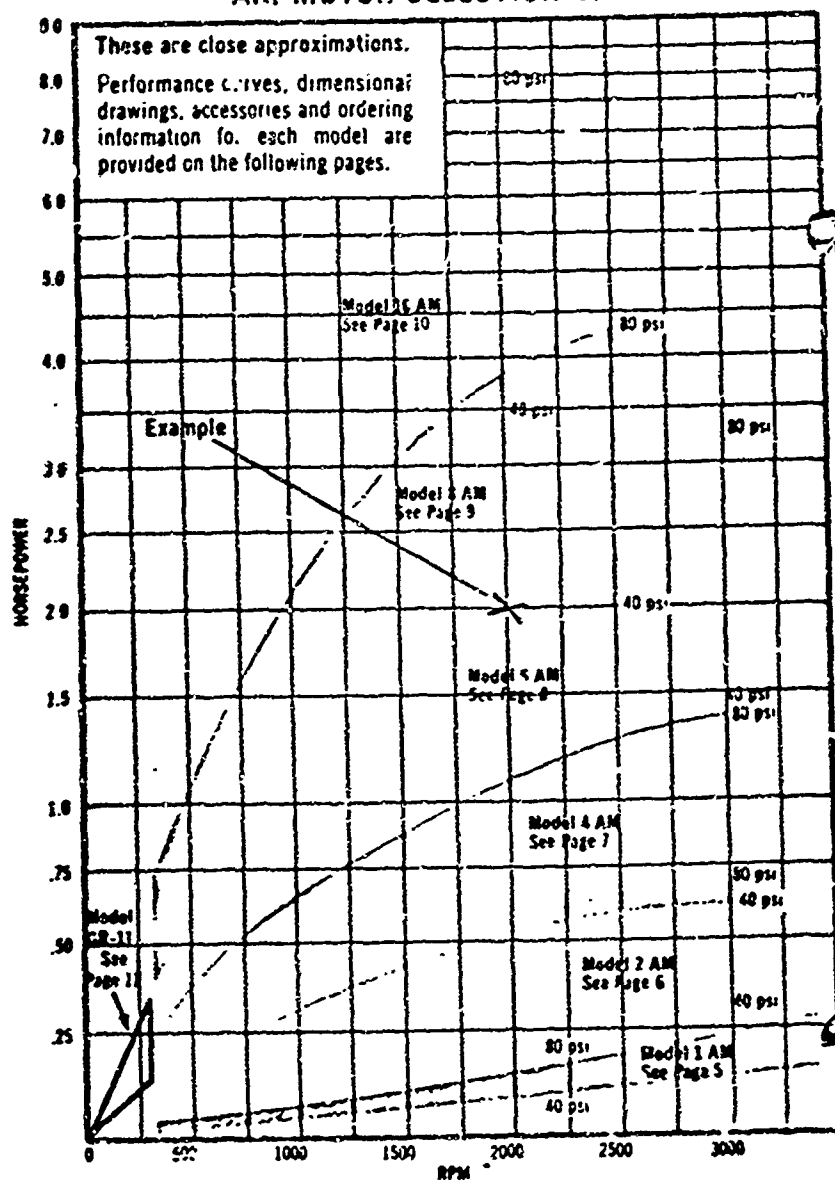


FIGURE 5

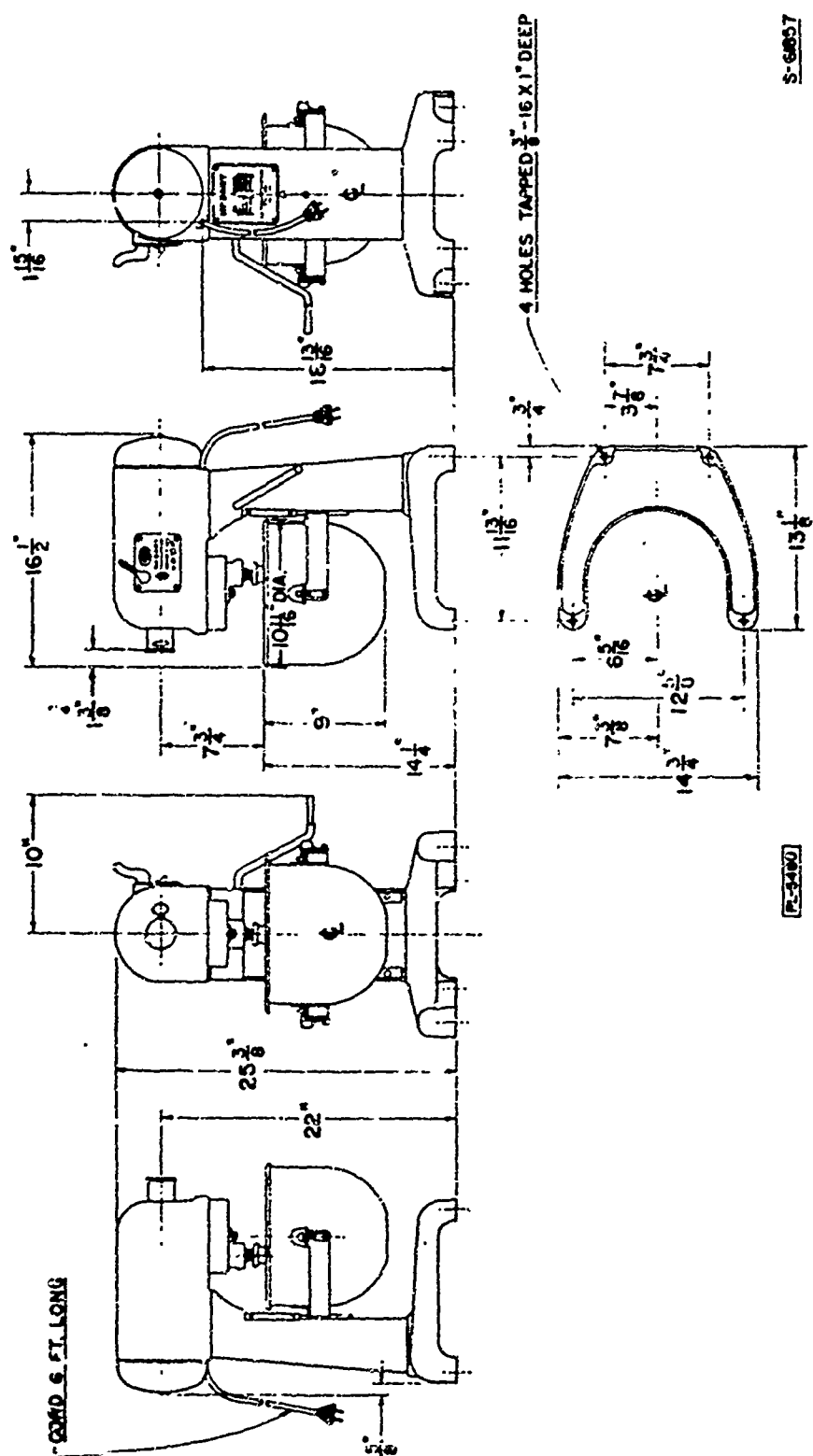
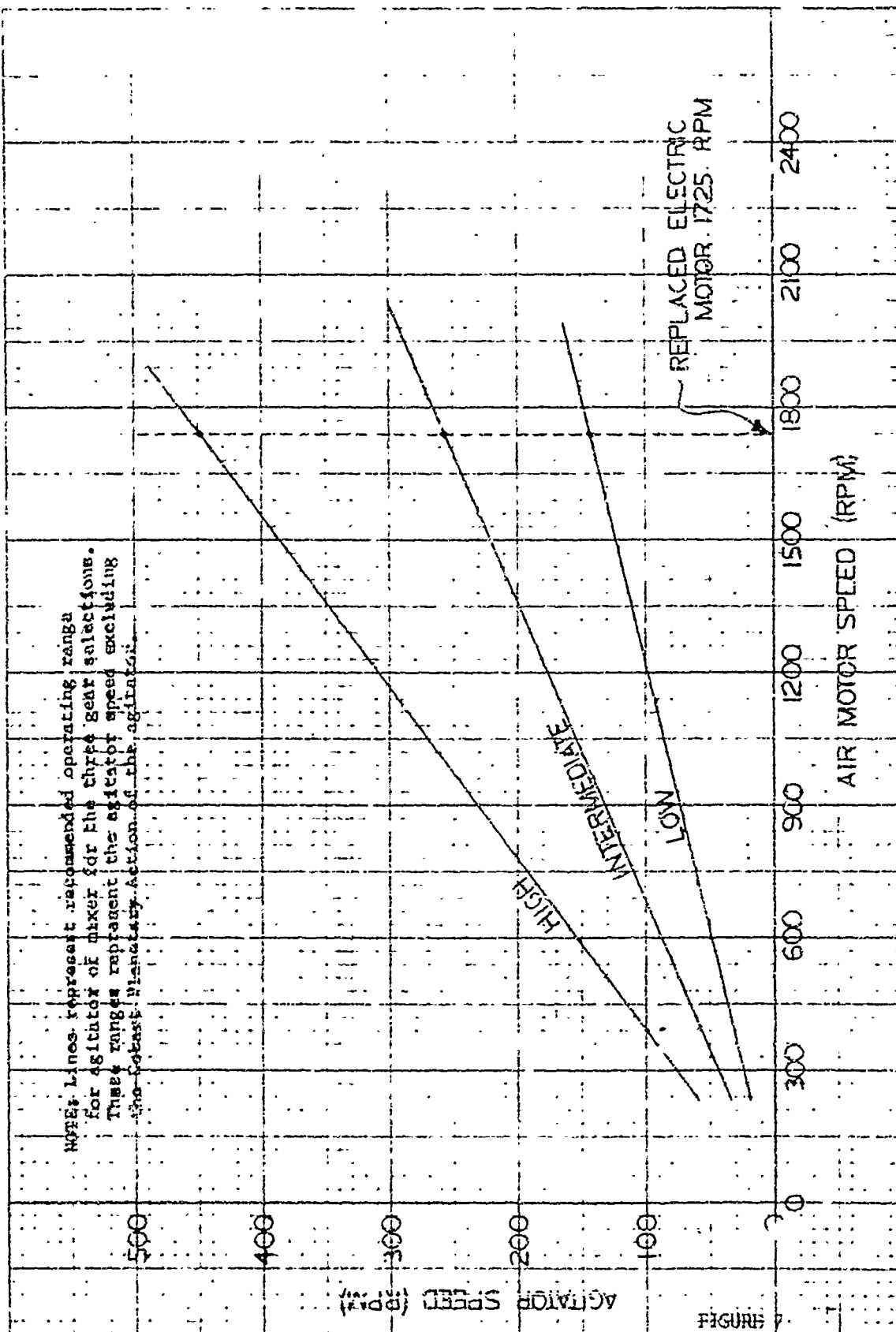
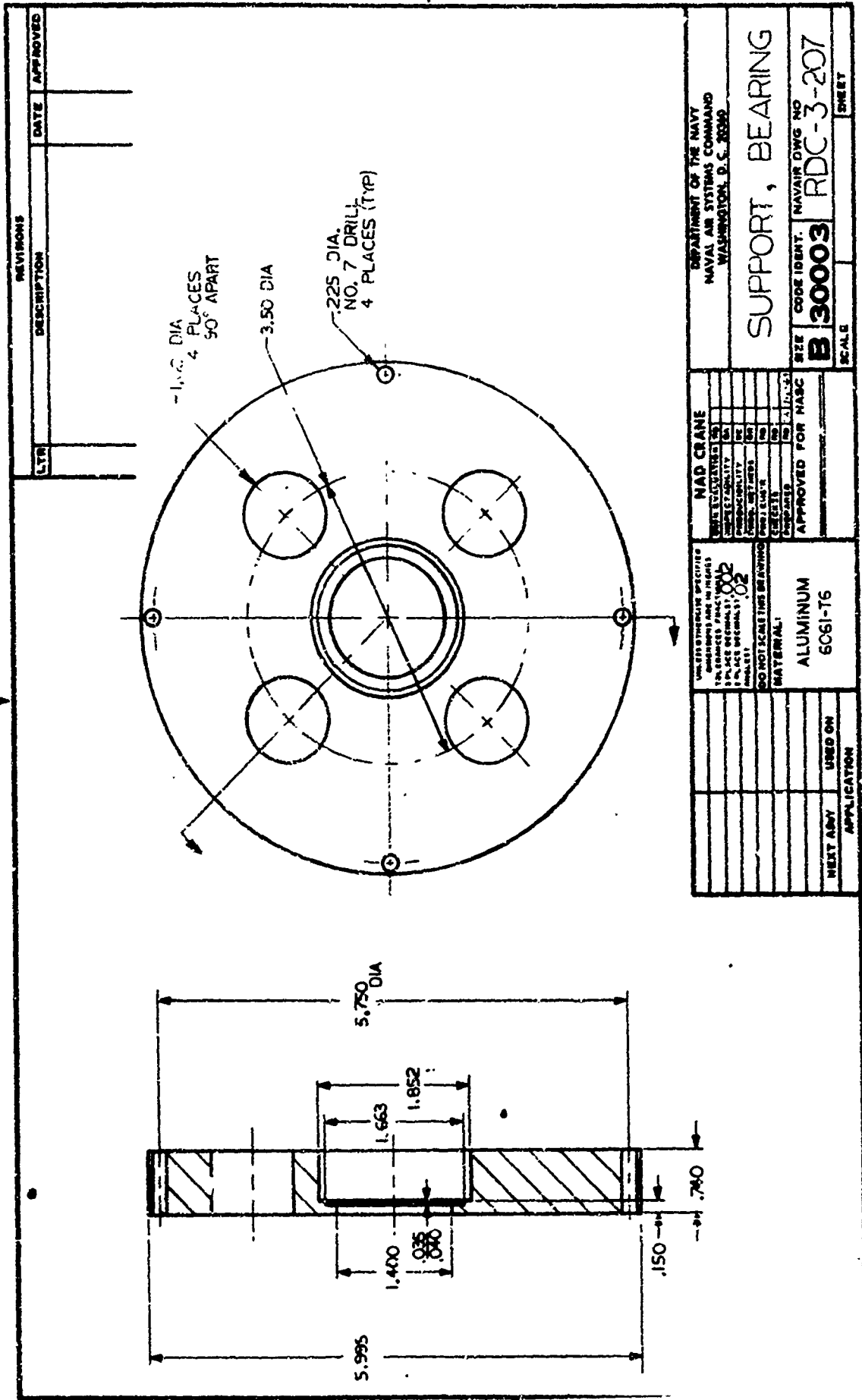


FIGURE 6









1. This drawing is the property of the Department of the Navy and is to be controlled as such. It is to be maintained in accordance with the instructions of the Department of the Navy.

REVISIONS		DATE	APPROVED
LTR	DESCRIPTION		

DEPARTMENT OF THE NAVY NAVAL AIR SYSTEMS COMMAND WASHINGTON, D. C. 20340		COUPLER	
NAD CRANE		SIZE CODE IDENT. NAVAL DWG NO <b>B 30003</b> RDC-3-202	
TEST EVALUATION NO. INSPECTION NO. PRODUCTION NO. PRODUCTION DATE PRODUCTION LOCATION PRODUCTION METHOD PRODUCTION MATERIAL		APPROVED FOR NADC APPROVED DATE APPROVED BY	
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES DECIMALS FRACTIONS PLACE DECIMALS PLACE FRACTIONS DO NOT SCALE DRAWING MATERIAL		COLD ROLL STEEL 1030	
NEXT ANY USED ON		APPLICATION	





UNCLASSIFIED

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13. ABSTRACT During development of a Catalyst Generator at Naval Ammunition Depot, Crane, Indiana, a special need arose for a somewhat universal mixer to thoroughly blend pyrotechnic mixes of various types under special conditions. The search for a mixer which could be used to mix these pyrotechnic mixes of approximately 10 lbs. in size, on a reproducible as well as a productive basis, led to the Model C-100 (Planetary Action) Mixer manufactured by the Hobart Manufacturing Company, Troy, Ohio. Preliminary testing of this mixer, with its planetary action, proved that it could meet the criteria already mentioned. One problem remained however, the Model C-100 Mixer is equipped from the factory with the standard type electrical motor and related equipment which would not permit the Model C-100 to be used to mix pyrotechnic mixes because of the safety requirements. Since this mixer provided the proper mixing action, it was suggested that the electrical motor and related controls (switches) be replaced with an air motor to adapt this mixer to meet the safety requirements involved.			

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14	KEY WORDS	LINK A		LINK B		LINK C	
		ROLE	WT	ROLE	WT	ROLE	WT
	Hobart Model C-100 Mixer Centrifugal Switch Agitator Motor Housing Stator Assembly Rotor Assembly Gast Air Motor Model 6AM-NRV-11 Bearing Support End Thrust Pyrotechnic Mixes Mixer Air Pressure Starting Torque Air Consumption Planetary Gearing Positive Speeds						

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